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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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AGILENT TECHNOLOGIES, INC.
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EXAMINER

SETH, MANAV

ART UNIT PAPER NUMBER

2625

DATE MAILED: 12/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/027,462

Applicant(s)

YAROSLAVSKY ET AL.

Examiner

Manav Seth

Art Unit

2625

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 December 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 and 21-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 15-20 is/are allowed.
- 6) ☒ Claim(s) 1-13, 21-28 and 30 is/are rejected.
- 7) ☒ Claim(s) 14 and 29 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 2, 3, 10, 11, 12, 21, 23, 24, 26, 27 and 28 are rejected under 35 U.S.C. 102(b) as being anticipated by Acharya et al, U.S. Patent No. 6,151,415.

- Claim 1 recites “ a method of automatically focusing an imaging system on an object comprising: using an image of the object created by the imaging system to determine an optimum focus position”. Acharya discloses of using an image created by the imaging system to determine an optimum focus position (column 3, lines 52-58).
- Claim 2 recites “The method of claim 1, wherein the optimum focus position is determined comprising: computing an edge density of each image of a set of images of the object; and using a focus position corresponding to an image of the set having a greatest computed edge density as the optimum focus position”. Acharya discloses of computing sharpness of each image captured by measuring edges of each image and selects the focus position used to capture that image that has the

highest sharpness parameter as the most optimal focus position (column 3, lines 52-58 and lines 24-30).

- Claim 3 recites "The method of claim 1, wherein the optimum focus position is determined comprising: applying a difference between a first focus position and a second focus position of the imaging system to a third focus position corresponding to the image of the object, such that the third focus position is adjusted to the optimum focus position, wherein the first focus position corresponds to a reference image of a typical object, and wherein the second focus position corresponds to an image of the typical object that closely matches the image of the object". Acharya discloses of comparison of two focus position sharpness parameters to determine the third focus position and the third focus position is adjusted to the optimal focus position (column 4, lines 30-36). Acharya also discloses the first focus position being a known focus position which is the default focus position of the lens and a known focus position is taken as a reference focus position (column 4, lines 18-21) and the second focus position is an image of the same scene (column 4, lines 27-29).
- Claim 10 recites "A method of determining an optimum focus position of an imaging system comprising: creating a set of images of an object at a plurality of different focus positions using the imaging system, wherein each image in the set is created at a different one of the plurality of focus positions, such that each image has an associated focus position".

Acharya discloses of a series (set) of captured images (each captured at a different focus length) of a scene (object) captured by an imaging device (column 3, lines 51-58). All other limitations that recites in claim 10 have been analyzed and are rejected as per claim 2.

- Claim 11 recites "The method of claim 10, wherein the computed edge density is a relative measure of edges in each of the images". Claim 11 has been analyzed and is rejected per claim 2.
- Claim 12 recites "The method of claim 10, wherein the edge density is computed using an edge density metric employing one of any gradient-based and any non-gradient-based edge detection and image processing methods". Acharya discloses employing of Discrete Wavelet Transform (DWT) to detect or measure the edge values (column 2, lines 32-36 and column 3, lines 20-29).
- Claim 21 recites "An imaging system having automatic focusing comprising: an imaging subsystem that images an object; a memory; a computer program stored in the memory; and a controller that executes the computer program and controls the imaging subsystem, wherein the computer program comprises instructions that, when executed by the controller, implement using an image of the object created by the imaging system to determine an optimum focus position". Acharya discloses an imaging system comprising of memory, processor (controller), and a

computer program stored in memory used to determine an optimum focus position (Figure 5; column 6, lines 33-67 and column 7, lines 1-15).

- Claim 23 has been analyzed and rejected as per claim 21 and claim 2.
- Claim 24 has been analyzed and rejected as per claim 21 and claim 3.
- Claim 26 has been analyzed and rejected as per claim 21 and claim 2.
- Claim 27 has been analyzed and rejected as per claim 21 and claim 2.
- Claim 28 has been analyzed and rejected as per claim 24 and claim 3.

3. Claims 1, 4, 5, 6, 7, 8, 9, 21, 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Frost et al, U.S. Patent No. 5,647,025.

- Claim 1 recites " a method of automatically focusing an imaging system on an object comprising: using an image of the object created by the imaging system to determine an optimum focus position". Frost discloses an imaging system that acquires an image to determine an optimum focus position (column 6, lines 11-13 and lines 41-64).
- Claim 4 recites "The method of claim 1, wherein using an image automatically accounts for warpage in the object". Frost discloses the best focus on the specimen (object) varies from point to point due to warpage (column 4, lines 40-43).
- Claim 5 recites "A method of automatically focusing an imaging system on an object comprising **one or both** of: using a first focus position corresponding to an image of the object created by the imaging system

that has a greatest edge density as an optimum focus position for the imaging system". Frost discloses determining of an initial (first) focus position, which is the best focus position with highest focus (sharpness) score (column 2, lines 26-30; column 5, lines 55-59; column 6, lines 10-20 and lines 53-54; and column 9, lines 1-25) and using this initial focus position of an image of the specimen (object) as the first focus position (column 7, lines 12-18). Claim 5 preamble claims to use **one or both** of the limitations for automatically focusing an image of an object, therefore only one limitation is used for the rejection.

- Claim 6 has been analyzed and rejected in view of Frost. Frost discloses:
 - Method of initial focus scan for determining the first focus position (column 6, line 6 and column 7, lines 12-18).
 - Acquiring and processing images from different focal planes of a specimen (object) (column 6, lines 11-12 and column 2, lines 23-26) which satisfies the limitation "creating a set of images of the object at a plurality of different first focus positions using the imaging system, wherein each image in the set is created at a different one of the plurality of first focus positions".
 - A focus measure is computed for each of the images, where each focus measure is a function of at least one image measurement (column 2, lines 26-29), which satisfies the limitation "such that each image has an associated first focus position".

- Measuring the gradient intensity to measure the edges for each image (column 7, lines 18-40 and column 6, lines 53-64), which satisfies the limitation "computing a density of edges for each image in the set".
- Claim 7 has been analyzed and is rejected as per claim 5. Claim 5 preamble claims to use **one or both** of the limitations for automatically focusing an image of an object. Claim 7 depends on the second limitation of claim 5 and since claim 5 indicates only one of the following two steps is necessary, claims that further limit the 2nd step do not further limit the 1st step, which is not by Frost. It is not necessary to show the specifics of claim 7 since claim 5 is in the alternative and 1st condition is not.
- Claim 8 has been analyzed and is rejected as per claim 7.
- Claim 9 has been analyzed and is rejected as per claim 5. Claim 5 preamble claims to use **one or both** of the limitations for automatically focusing an image of an object. Claim 9 depends on both limitations of claim 5 but the second limitation, which recites the adjusting of second position, is not required to be considered according to the preamble of claim 5. However, Frost discloses the best focus on the specimen (object) varies from point to point due to warpage (column 4, lines 40-43).
- Claim 21 recites "An imaging system having automatic focusing comprising: an imaging subsystem that images an object; a memory; a computer program stored in the memory; and a controller that executes

the computer program and controls the imaging subsystem, wherein the computer program comprises instructions that, when executed by the controller, implement using an image of the object created by the imaging system to determine an optimum focus position. Frost discloses:

- An imaging apparatus (system), which comprises of a computer and image processor (Figure 1).
 - Software processes embedded in image processors (controllers) to implement the various processes of autofocusing to determine the optimum focus position (column 4, lines 9-14 and column 6, lines 53 – 64).
- Claim 22 has been analyzed and is rejected as per claim 21 and claim 5.
 - Claim 23 has been analyzed and is rejected as per claim 5 and claim 6.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Acharya et al, U.S. Patent No. 6,151,415 in view of Coates, U.S. Patent No. 4,816,919.

- Claim 13 recites "The method of claim 12, wherein a smoothing filter is applied to the image prior to calculating gradients for the gradient-based edge detection". Acharya does not teach of applying a smoothing filter to the image prior to calculating gradients for the gradient-based edge detection.

Coates discloses of using a digital filter before the focus measure for the image is obtained (column 3, lines 25-31).

While Acharya does calculate the measure of the edges to determine the sharp optimal focus (column 3, lines 20-28 and lines 51-58), the reference does not disclose the use of smoothing filter prior to calculating the measure of edges (gradient). However, Coates uses a smoothing filter before the focus measurement is obtained. Therefore, it would have been obvious to one having the ordinary skill in the art at the time of the invention was made, to combine the invention of Acharya with that of Coates. One would have been motivated to add the step of filtering the image by adding smoothing filter of Coates to the invention of Acharya before the measurement of edges (gradient calculation) in an image is done to obtain a optimum focus position because the filter will provide to remove the spikes caused by the Gaussian noise which are slow spaced frequency brightness variations in the images due to intrinsic errors and variations in the imaging system (see Coates, column 3, lines 27-31).

6. Claims 25 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Acharya et al, U.S. Patent No. 6,151,415 in view of Rooks, U.S. Patent No. 5,719,952.

- Claim 25 recites "the image system of claim 21 being an x-ray laminography system". Acharya does not teach of the image system being an x-ray laminography system.

However, Rooks discloses an Scanned-Beam X-ray Laminography inspection system which is based on established automated X-ray technique capable of focusing on a plane of interest to examine features within this plane with great detail and contrast (column 4, lines 11-16).

Rooks does not disclose the specifics of obtaining the focused image position but does indicate in column 4 that the plane in focus is significant and Acharya does disclose the specific steps of obtaining automatically the highly focused image position. Therefore, it would have been obvious to one having the ordinary skill in the art at the time of the invention was made, to combine the invention of Acharya with that of Rooks. One would have been motivated to combine the invention of Acharya with that of Rooks because once the highly focused position for the first object under test has been obtained using Acharya's method, the system will use the first focus position as a reference position to automatically find best focus position for the second object under test at higher speed.

- Claim 30 has been analyzed and is rejected as per claim 25.

Allowable Subject Matter

7. Claims 15-20 are allowed.

The following is an examiner's statement of reasons for allowance:

The instant invention relates to a method of determining a change in focus position of an imaging system. The invention method comprises comparing the image of the second object to the images in the set of images of the first object to find a closest matching image, first object to find a closest matching image, the closest matching image from the set having an associated third focus position; and determining a change in the second focus position to provide an optimum focus position for imaging the second object with the imaging system. These features in combination with the other elements of the claim 15, are not disclosed or suggested by the prior art of record. Claims 16, 17, 18, 19 and 20 are dependent on the allowable claim 15, and thus they are allowable.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

8. Claims 14 and 29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Bose et al, U.S. Patent No. 5,040,228 discloses of a method and apparatus for automatically focusing an image-acquisition device.
- Trigg, U.S. Patent No. 6,433,325 discloses the apparatus and method for image enhancement.
- Leonard et al, U.S. Patent No. 4,928,313 discloses the method and system for automatically visually inspecting an article.
- Dwyer, U.S. Patent No. 6,181,270 discloses the reference based autofocusing method for IFSAR and other applications.

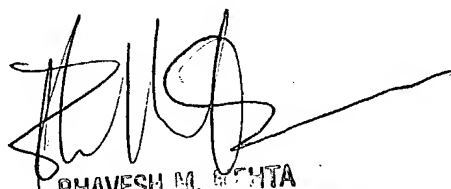
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Manav Seth whose telephone number is (703) 306-4117. The examiner can normally be reached on Monday to Friday from 8:30 am to 5:00 pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta, can be reached on (703) 308-5246. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Manav Seth
Art Unit 2625
November 19, 2004



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